# LETTERS TO THE EDITORS

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## Tastes of Oxygen and Nitrogen at High Pressures

WHILST carrying out experiments on behalf of Admiral Sir M. E. Dunbar-Nasmith's Physiological Sub-Committee for saving life from sunken submarines, we and other subjects have had occasion to breathe oxygen, air and other gas mixtures at high pressures.

When oxygen was breathed at 6 atmospheres, several subjects noticed a peculiar taste, which was enhanced at 7 atmospheres. None of them noticed it at 3 atmospheres. The taste is both acid and sweet. Two subjects described it as "like dilute ginger beer", and "like dilute ink with a little sugar". It was felt unevenly, by one subject mainly on the back of the tongue, by another beneath it. In one case it persisted for some minutes after ceasing to breathe oxygen. It may be remarked that although oxygen is a convulsant at such high pressures, it can be breathed with complete safety for long enough to taste it.

In air at 10 atmospheres, and sometimes even at 8 atmospheres, a number of subjects reported a taste which is variously described as harsh, metallic, and indefinable. It is certainly not due to oxygen, and one subject who tasted it regularly in air did not do so when mixtures in which the nitrogen of air had been replaced by helium or hydrogen were breathed at 10 atmospheres. We therefore attribute it to nitrogen.

Not all subjects reported these tastes. This was probably often due to the fact that other sensations were distracting them, and to the narcotic effect of nitrogen at high pressures. However, one subject who was repeatedly on the look-out for both tastes has never tasted nitrogen, and only tasted oxygen very faintly at 7 atmospheres. His sense of taste is, however, poor as a result of cerebral concussion.

We conclude that the taste threshold for oxygen lies below 6 atmospheres and for nitrogen below 8, in about half of the persons tested. So far only one person has reported an abnormal smell, in compressed air, but perhaps oxygen and nitrogen may have smells at still higher pressures.

It is clearly inaccurate to describe a gas as inodorous and tasteless. On the contrary, most or all gases may be expected to display these properties at sufficiently high pressures, just as they liquefy at sufficiently low temperatures. Whether men can survive the pressure under which, say, hydrogen develops a taste or smell is, of course, as yet unknown.

We have to thank the Admiralty and Messrs. Siebe Gorman and Co. for making this research possible.

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## Ascorbic Acid and Resistance to Low Oxygen Tension

IN an article published in the *Lancet* of June 28, Stewart, Learmonth and Pollock record experiments which show that the intravenous administration of ascorbic acid prolongs the life of cats after severe hæmorrhage. They suggest that ascorbic acid secures a more adequate supply of oxygen to the tissues.

Experiments which have been carried out in this Institute by Dr. B. G. B. Lucas, in an attempt to make oxygen more available to the tissues of animals subjected to low atmospheric pressures, have yielded similar results. Both methylene blue and ascorbic acid, administered intraperitoneally, have been found to increase the resistance of mice and rats to low oxygen tensions. A mouse, injected with methylene blue or ascorbic acid, may survive a number of consecutive exposures to atmospheric air at a pressure of 120 mm. mercury, while, on each occasion, an untreated companion succumbs.

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## Pharmacological Classification of Steroid Hormones*

UP to the present, the physiological classification and terminology of steroid hormones was based either on one of their outstanding actions ('œstrogens', 'progestins') or on their source of origin ('corpus luteum hormone', 'adrenal cortical hormone', 'testis hormone'). Such a classification is no longer possible, since we know, for example, that 'testis hormones' may originate in the adrenal cortex and may exert 'œstrogenic' actions. In spite of the considerable overlapping between the physiological actions of the steroid hormones, they can and must be classified into certain groups. It is felt that the best solution of the problem is to *classify the steroid hormone actions according to the degree to which they are able to imitate or substitute for the function of a certain endocrine gland.* Accordingly these groups might be given names reminiscent of the glands and yet indicating that this does not imply that such glands are the only source of the hormone.

Thus progesterone imitates the action of a corpus luteum and œstradiol that of an active follicle even though these hormones may originate from cells other than those of the corpus luteum and the ovarian follicle respectively. The grouping of the steroids into œstrane, androstane and pregnane derivatives is a satisfactory basis for the classification of their

* Abridged.

chemical properties. As a designation for the whole groups of hormones having a structure reminiscent of the sterols, Callow and Young[1] suggested the name of 'steroid' which has generally been accepted. The Greek ending 'oid' derived from εισος meaning form, has often been used in pharmacology to designate compounds similar in their actions to those described by the work preceding this ending (for example, toxoid). Accordingly, the four main types of steroid hormone-like actions might be described as corticoid, luteoid, folliculoid and testoid. Thus without introducing any essentially novel terms, we could classify the steroid hormones into four main pharmacological groups according to the principles mentioned above :

*Corticoid* = having activity of : cortin, adrenal cortical hormone, principle maintaining life of adrenalectomized animals, etc.

*Luteoid* = having activity of : progestin, corpus luteum hormone, progesterone, luteine, β-hormone, kythine, luteohormone, corporin, relaxin, mucifying hormone, luteocrinine, etc.

*Folliculoid* = having activity of : œstrin, œstrogenic hormone, feminine, gynæcogenic hormone, menformon, folliculin, α-hormone, follicular hormone, female hormone, etc.

*Testoid* = having activity of : androkinin, male hormone, testis hormone, androgenic hormone, etc.

It may incidentally be mentioned that the term 'cortin' has now lost its original meaning as a generic term for adrenal cortical hormone activity since Hartman *et al.*[2] now distinguish between the "vital factor, cortin" and the "sodium factor". This means that desoxycorticosterone acetate is both a 'cortin' and a 'sodium factor', while some of Hartman's cortin preparations are apparently devoid of the latter activity. If this type of subdivision were carried over to the group of the testoids, androsterone would have to be called prevailingly a 'prostate factor' and testosterone a 'seminal vesicle factor'. Subdivision carried to this degree is of no particular value as it eventually leads to the mere statement of single characteristics which can much better be done by the generally accepted practice of merely stating the degree to which the compound has 'metrotropic', 'mammotropic', 'renotropic', pituitary-enlarging, life-maintaining, etc., ability. While the determination of all these activities is evidently of importance, it is felt that for the reasons mentioned above, the single action can be used as a basis for a classification. On the other hand, the classification suggested in this note has none of these deficiencies, and the proposed group names are equally applicable to artificial compounds and true hormones. It is hoped they will prove useful at this time when so much work is done on a multitude of newly synthetized steroid compounds with hormone activity.

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June 16.

[1] Callow, R. K., and Young, F. G., *Proc. Roy. Soc.*, A, **157**, 194 (1936).
[2] Hartman, Frank A., Spoor, H. J., and Lewis, L. A., *Science*, **89**, 204 (1939).

## Nomenclature of Pituitary Autacoids

THE nomenclature of pituitary autacoids is unsatisfactory, and current terminology with reference to those of the anterior lobe is particularly at fault. The terms thyrotropic and gonadotropic are in general use. These terms are misleading. The Greek word τροπος or τροπη means *a turn, return,* or *turning about* and the verb τρεπω from the same root can be used transitively to signify *direct* or *guide*.

We have long-established precedent for this root in current biological literature. The *phototropic* or *geotropic* behaviour of a plant signifies that it turns towards or away from light or the centre of the earth. The same words have also been used to describe the behaviour of an animal when it moves to or from a source of light or the earth's centre. Students of animal behaviour have very properly recognized that this is inconsistent with scientific usage. Consequently they have substituted *phototaxis* and *geotaxis*.

Dr. A. S. Parkes has suggested the use of the term *gonadotrophic* instead of *gonadotropic*[1]. The meaning of the Greek root of the suffix *trophic* would indicate that the hormone feeds the gonads. This is far from certain and it is possible to choose a more appropriate root which can be applied to all the activities of the pituitary gland. It is certain that there is some physiological connexion or link between the specific activities of the anterior lobe and the thyroid, gonads, etc.

One Greek word which meets our requirements is δεσμος, which means a bond, fetter, or link. This suggests the following terminology for the anterior lobe autacoids :

(1) thyrodesmic (*thyrotropic*)
(2) blastodesmic or *growth-promoting*
(3) oodesmic or *follicle-stimulating*
(4) xanthodesmic (*luteinizing*)
(5) androdesmic or *testicle-stimulating*

(3), (4), (5) } gonadodesmic

(6) galactodesmic (*galactogogue*)

One objection to the items of this list is that growth-promoting is sufficiently explicit. For those who prefer native words to international terms, thyroid-stimulating is certainly better than thyrotropic.

Existing terminology of the posterior lobe autacoids is not open to the same objections. The term oxytocic is not inherently inconsistent with established usage of Greek affixes. Still, it is open to the criticism that it contains no familiar root which suggests its meaning. For the English-speaking scientific worker, uterine stimulant is therefore a better term than oxytocic activity. From every point of view Hogben's *melanophore stimulant* is preferable to *chromatropic*. Until it is possible to distinguish between the substances responsible for melanophore stimulation and erythrophore stimulation the adjectives *melanodesmic* and *erythrodesmic* might be appropriately used. *Pressor substance* is sufficiently explicit from the point of view of the English-speaking world and is in accordance with international usage. So also is the term *anti-diuretic*. For those who prefer a uniform nomenclature, I suggest the following :

(1) hæmodesmic (*pressor*)
(2) splanchnodesmic (*oxytocic*)
(3) (*a*) melanodesmic (*b*) erythrodesmic
(4) nephrodesmic
(5) leucodesmic (the at present hypothetical "*W*" substance of Hogben and Slome).

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June 23.

[1] NATURE, **141**, 36, 73 (1938).